

ing genus" of this class. It is inferior to most Siphonæ in every respect except the heterogamous reproduction.

In the class Cænobiæ the orders Pandorinæ and Volvocinæ should, we think, have been united, or at least placed in juxtaposition.

A few words on fossil Algæ conclude this section.

The fifth subdivision, Fungi, is very clearly described, in general agreement with de Bary's views. The Fungi are divided into Phycomycetes and Sporocarpeæ, the former including the Oomycetes and Zygomycetes, the latter the Ascomycetes, Uredinæ, and Basidiomycetes. We may note that the Ustilaginæ are included among the Zygomycetes, de Bary's opinion as to the sexuality of the cell-fusions in the former groups being adopted, while Brefeld's opposite view is severely criticized. The phenomena in question are really on the confines of sexuality, and both opinions are tenable. It may be, however, that we have a definite test in the fusion of nuclei, and if Fisch's observations are to be trusted this test goes against the sexuality of the Ustilaginæ.

The account of the Ascomycetes is essentially based on de Bary's work. Due stress is laid on all the cases in which it is possible to find any indication of sexual reproduction. Perhaps it would have been better to point out that there are two sides to the question, and that the views of Brefeld, van Tieghem, and Moeller also have to be taken into account.

The statement that a nucleus has not yet been demonstrated in yeast-cells shows an excess of scepticism. The evidence afforded by Zacharias's observations is as convincing as in the case of any other fungal cells.

The Uredinæ are rather curtly disposed of. In tracing their relationship to the Basidiomycetes, the authors regard the teleutospores and basidiospores as corresponding structures. Several facts may be adduced in support of this view, but on the whole we prefer de Bary's ingenious interpretation, according to which the teleutospores are homologous with the basidia, the promycelium with the sterigmata, and the sporidia with the basidiospores. This comparison rests on very strong evidence, as an inspection of Figs. 130 and 140 in de Bary's "Fungi" will show.

The next subdivision is that of the Mycetozoa. If, as the authors, in agreement with most authorities, state, "we are justified in placing the Mycetozoa outside the limits of the vegetable kingdom" (p. 406), it seems to be time that these organisms were excluded from botanical hand-books.

The last subdivision, Protophyta, is a most heterogeneous group, including the Protococcoideæ, Diatomaceæ, Cyanophyceæ, and Bacteria. In our opinion, the two first-named groups would have been much better placed among the Algæ, and the same probably applies to the Cyanophyceæ, though here there is more room for doubt. This would only leave the Bacteria, and these must eventually accompany the Cyanophyceæ, from which they seem to differ in nothing except the usual absence of chlorophyll. It must be mentioned, however, that the authors themselves fully recognize that the Protophyta are not a natural subdivision.

The work as a whole is a useful summary of Cryptogamic morphology, but there is room for very material emendation. Many inaccuracies occur, some of which

have been noticed above, and though these mistakes are no doubt largely due to oversights in revision, they are none the less misleading to the reader. We think also that in some cases, especially as regards the Vascular Cryptogams and the Protophyta, the authors have not made sufficient effort to render their classification as natural a one as possible.

It is especially to be regretted that so few good new figures have been introduced. Nothing adds so much to the freshness and interest of a hand-book as good and original illustrations, while the constant reappearance of familiar text-book figures, however well selected, has become very wearisome, and is unworthy of a living and active science.

We hope that opportunity may be found in a second edition to render this book in every way a satisfactory account of flowerless plants. It should be mentioned that there is a very good and complete index.

D. H. S.

AN ENGLISH RAILWAY.

The Working and Management of an English Railway.

By George Findlay, General Manager of the London and North-Western Railway. (London: Whittaker and Co., 1889.)

TO write a good book on the working and management of an English railway is no easy matter. The author of such a work must have an intimate knowledge of his subject, and be in a position to take one of our best English railways for his pattern. It would be quite possible to name more than one railway in this country, the management of which would, if described in a book, serve to illustrate how such a task should not be fulfilled. This, however, does not apply to the present volume. It is a pleasure to read a book on the subject by Mr. Findlay, the General Manager of the London and North-Western Railway, for where would it be possible to find a better managed line than the North-Western Railway?

In a volume of 270 pages, divided into sixteen chapters, the author treats departmentally the various sections of staff and plant necessary for the efficient working and control of this vast system of railways. Chapter ii. deals with the management of the line, and it is evident that this is most thoroughly carried out by means of a system of devolution of responsibility. The author says, "It will thus be seen that the chain of responsibility and supervision is a very complete one, and, in fact, the secret of organizing the management of a great service, such as this, is nothing more than a carefully arranged system of devolution combined with watchful supervision." The staff consists of about 55,000 men, including all grades in the service. It is interesting to note that promotion does not depend on seniority, but solely on merit, the best man for the particular post being chosen; and this no doubt is the only way of getting work well done.

In the chapter on the "Permanent Way" the subject is treated historically. The old cast-iron rails laid on stone blocks are illustrated as a relic of the early days of railways, and the reader is gradually led through the various changes and improvements made therein, until he reaches the standard road of the North-Western of to-day, which is as nearly perfect as it can be made with

our present knowledge. Signals and interlocking are efficiently dealt with in chapter v. Then the telegraphs are equally well described in chapter vi. The rolling-stock of a railway forms probably the most important part of the necessary plant, and is affected more than anything else by the gradually increasing speeds and weights of trains. Chapters vii. and viii. deal with this important subject. The standard types of locomotives are very well illustrated, but the descriptions might with advantage have been more detailed. The author discusses the necessity for an increase of power in the passenger locomotives to cope with the increased weight of the principal express trains, and the solution of the problem by the introduction of Mr. Webb's fine compound locomotives. The construction and working of these engines are described clearly enough for the benefit of non-professional readers. It would have been interesting to find an account of the Worsdell compound locomotive, which, although not in use on the North-Western, has many points in its favour. Comparing it with Mr. Webb's engine, many engineers consider it the better engine of the two. Perhaps in a future edition Mr. Findlay might add a description of it, with an illustration.

Carriages and different kinds of rolling-stock are well dealt with, and it is evident that the author has taken the utmost pains to get his information up to date. The locomotive works at Crewe, and the carriage and wagon works at Wolverton, are capably described. With reference to the automatic vacuum brake, described on p. 120, it is evident that this brake is automatic on the coaches *as well as* on the guards' vans. As this is probably of recent introduction, the North-Western Company are to be congratulated on its adoption in their rolling-stock. The earlier vacuum brake fitted was nothing more than the simple non-automatic vacuum brake as far as the coaches were concerned, and was justly condemned by most railway engineers for that reason.

The remaining chapters deal with the working of the trains, shunting and marshalling of goods trains, the working of goods stations, rates, fares, traffic, &c. With regard to all these matters the writer's statements are clear, concise, and to the point.

It would be of great service to the railway world generally if some of the head officials of the best English railways would follow Mr. Findlay's example, and give us some of their stores of experience. Take, for instance, locomotive engineering: where is the student or apprentice to find a book of recent date on the design, construction, and working of the modern locomotive? Let us hope that the infection will spread on the North-Western staff, and that by and by Mr. F. W. Webb, the able Locomotive Superintendent of that railway, will write a book on the department in which he so greatly excels.

Mr. Findlay's book displays so much knowledge and ability that it well deserves to rank as a standard work on the subject.

N. J. L.

OUR BOOK SHELF.

Zur Geologie der Schweizeralpen. Von Dr. Carl Schmidt. One Plate. (Basel: Benno Schwabe, 1889.)

THIS pamphlet gives a summary of the views entertained at the present time by many leading Swiss geologists as to the geological history of the Alps. So far as we can

see, it does not profess to be more than a compilation, or to contain any original work; but as a summary it is as clear and concise as the subject permits. The author, in the first chapter, briefly sketches the history of the principal types of rock which enter into the composition of the Alps; and, as might be expected at the present juncture, lays much stress upon the results of pressure. Some, indeed, may think that the present moment is rather inopportune for such a memoir as this; for the modifications due to pressure, especially in rocks already crystalline, are still the subject of so much controversy among geologists, that it is difficult to know what may be taken for granted; and there is a danger, if the writer be a disciple of the new school, of confusing the results of demonstration and of hypothesis. A quotation (translated) will indicate the author's point of view better than a general statement. After pointing out that two great rock groups exist in the Alps, one consisting of various granitoid rocks, gneisses, and crystalline schists, the other of limestones, sandstones, and other sediments, he proceeds—"In Switzerland the region which intervenes between the two zones is not very broad. The general strike of this intermediate zone is through Coire, Ilanz, the Greina Pass, Scopi, Airolo, Nufenen, the Rhone Valley, to Martigny, and so through the Val Ferret to the Little St. Bernard. The rocks of this intermediate zone are crystalline sediments, the age of which it is difficult to fix with precision. In the Grisons they have lately been claimed by Gümbel as Palæozoic, in the Valais they have been shown by Lory to be Triassic: that the same, from the Greina Pass to the Nufenen, are Jurassic, can be proved by fossils." This, however, begs the whole question. It has yet to be shown that the Swiss geologists have not confused together, as some maintain, two distinct rock groups, owing to their having mistaken (not for the first time) for crystalline schists, deposits which only simulate the latter, because they are locally composed almost entirely of their *débris*.

But, putting aside theoretical and controversial matters, the author's summary is generally clear. It would, we think, have been more useful if he had condensed somewhat the general discussion in the opening chapter, and dwelt more fully in the others on the many interesting questions of local physiography which are opened up by a study of the Alps. To this objection, however, an exception must be made in the case of the Nagelfluë, where Dr. Schmidt's remarks are very interesting. In certain of these great masses of conglomerate, pebbles of crystalline rocks are fairly common. These, he states, whether granites, gneisses, or crystalline schists, show no indications of the dynamic metamorphism which is exhibited by similar rocks in the adjoining chain of the Alps. From this observation, if confirmed by further research, it would result that the "schistosity," or secondary foliation, which is so marked a feature in most parts of the Alps, has resulted not from the post-Eocene but from the post-Miocene set of movements.

Die Entstehung der Arten durch räumliche Sonderung. Gesammelte Aufsätze von Moriz Wagner. Herausgegeben von Dr. med. Moriz Wagner. (Basel: Schwabe, 1889.)

OF later years, zoological literature has been significantly full of contributions, advocating now addition to, now subtraction from, the theory of "evolution by means of natural selection" formulated by Darwin—contributions, the chief characteristics of which are that they are mutually destructive, that they are, comparatively speaking, unsupported by any serious array of observed facts, and that none of them meet with more than a few adherents. We do not believe that truth is appreciably advanced by ingenious speculation of that nature; it is certainly in so far retarded that the energy thus expended would have been better applied in placing Darwin's con-